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Supercontinuum generation from ultraviolet to mid-infrared

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Abstract*. The advent of photonic crystal fibers (PCFs) has paved the road for commercial high-power supercontinuum light sources. The air-hole structuring in the PCF manipulates the properties of light and gives a tremendous degree of design freedom, which has enabled pushing the properties of PCFs to limits that can never be achieved with standard step index fibers. For example, one can move the zero dispersion wavelength (ZDW) into the visible [1] and make them endlessly single moded [2]. For efficient supercontinuum generation it is of great importance that the pump wavelength is close to the ZDW. We demonstrate how the spectral blue-edge can be manipulated by careful fiber design and tapering of the PCF enabling supercontinuum generation spanning all the way from 380 nm to 2.4μm [3]. We discuss the limiting factors of the supercontinuum bandwidth. Furthermore, we discuss how the fiber tapering influences the intensity noise of the supercontinuum source [4].*

Supercontinuum sources based on silica fibers are limited to the material loss edge at 2.4 μm. However, for wavelengths beyond 2.4 μm the attenuation of light in silica fibers is greatly increased making them useless for the mid-infrared region. Instead, other fiber materials such as fluoride-based glasses (ZBLAN) and chalcogenide glasses can be used for mid-infrared supercontinuum generation. We will show supercontinuum generation in ZBLAN fibers covering 1.5-4.5 μm [5] and super-continuum generation in microstructured chalcogenide fibers out to 9 μm. We discuss the prospects for extending the supercontinuum generation beyond 10 μm and highlight useful applications such as cancer detection and food analysis.

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